

Accuracy of Orthopedic Surgeons versus Epic in Prediction of Operating Room Times

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BACKGROUND

Operating room efficiency is affected by several medical and administrative factors. Despite the integration of machine learning in electronic health record systems such as Epic, accurate prediction of case time continues to present variable outcomes. The purpose of this study is to compare the accuracy of the electronic health record versus surgeons in the prediction of operating room times.

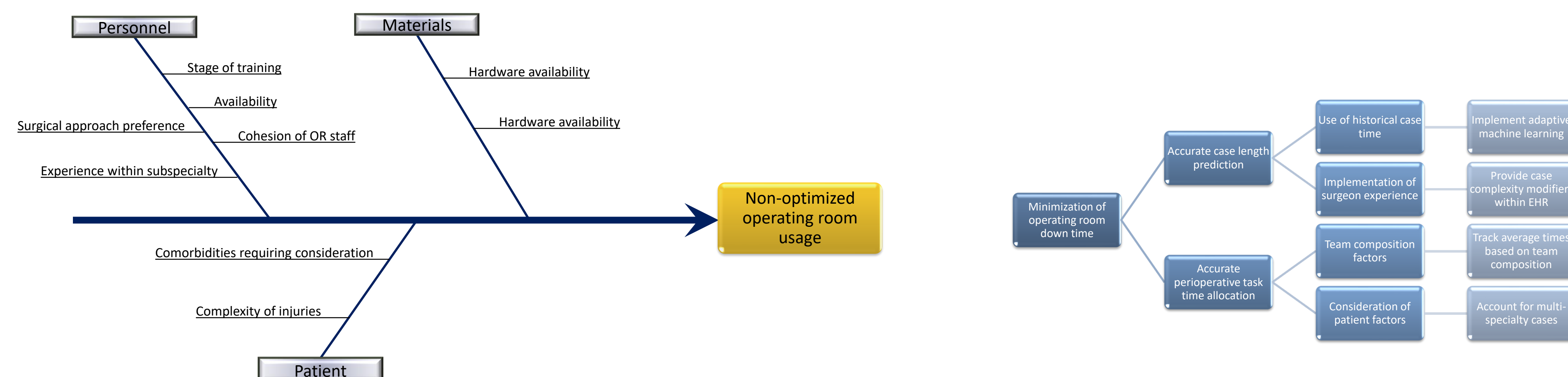
SMARTER OBJECTIVE

- S – Ensure optimal operating room scheduling given surgeon provided time versus Epic provided time
- M – Threshold of +/-30% of scheduled time used as marker of accuracy
- A – Using systems already in place and prospective surgeon estimation
- R – Minimize wasted operating room time
- T – Examined over 2-month period
- E – Periodic evaluation to verify accuracy
- R – Adjust method of scheduling to reflect most accurate predictions

METHODS

A prospective study was completed at a level 1 trauma center examining orthopedic case time estimation. After inclusion and exclusion criteria was met, 326 cases were included in the study. Operating room durations were calculated and the difference between predicted and actual times were compared between Epic and surgeon predictions. A prediction within 30% of the actual case duration was considered correct. Time differences between Epic and surgeon predictions were compared and T-test and ANOVA analysis were used to compare groups stratified by subspecialty service and number of procedures per case.

IMPROVEMENT ACTION PLAN



RESULTS

The Epic predicted OR time demonstrated a 77.9% accuracy whereas surgeon prediction demonstrated a 48.2% accuracy. Epic predicted OR time resulted in a sum discrepancy of a 1007-minute underestimation with an absolute difference of 9941 minutes, whereas surgeon predicted OR time resulted in a sum discrepancy of 13014 minutes underestimation with an absolute difference of 15850 minutes. ANOVA and post-hoc t-tests between surgeon predicted case time and Epic predicted time stratified by subspecialty service showed significance between spine-joint and spine-trauma. T-tests comparing the differences between single procedure cases and multi procedure cases for both Epic and surgeon predicted times demonstrated significantly increased discrepancies in multi-procedure cases.

Table 1. Epic-Predicted OR Time and Surgeon-Predicted OR Time versus Total OR Time

	Surgeon Correct	Surgeon Incorrect	Total (%)
Epic Correct	140	114	254 (77.9)
% column	89.17	67.46	
% row	55.12	44.88	
% total	42.94	34.97	
Epic Incorrect	17	55	72 (22.1)
% column	10.83	32.54	
% row	23.61	76.39	
% total	5.21	16.87	
Total (%)	157 (48.2)	169 (51.8)	326

Table 2. Epic-Predicted OR Time and Surgeon-Predicted OR Time versus Total Case Time

	Surgeon Correct	Surgeon Incorrect	Total (%)
Epic Correct	170	84	254 (77.9)
% column	85.86	65.63	
% row	66.93	33.07	
% total	52.15	25.77	
Epic Incorrect	28	44	72 (22.1)
% column	14.14	34.38	
% row	38.89	61.11	
% total	8.59	13.5	
Total (%)	198 (60.7)	128 (39.3)	326

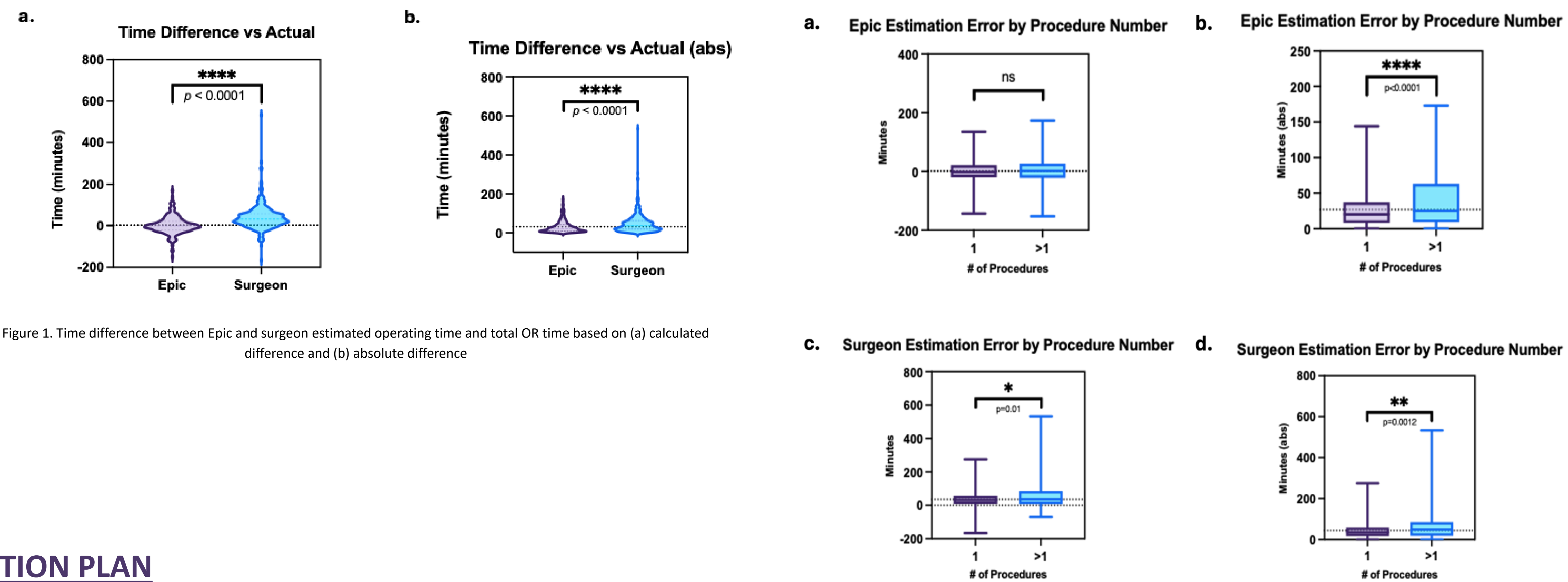


Figure 1. Time difference between Epic and surgeon estimated operating time and total OR time based on (a) calculated difference and (b) absolute difference

Figure 2. Cases stratified by number of procedures per operation. (a) No significant difference was found between single and multi-procedure surgery calculated time estimation error. However, (b) absolute value of the Epic estimation error, (c) calculated value of the surgeon estimation error and the (d) absolute value of the surgeon estimation error all showed significant difference in accuracy and underestimation of OR time.

SCALE UP PLAN

- Though validation should be completed for each surgical specialty, the results of this study may be generalizable to all OR scheduling.
- Processes for validation of Epic generated procedure times, real time feedback, and post-operative reporting could serve to enhance the accuracy and precision of the electronic health records operating room scheduling system.

SUSTAINABILITY PLAN

- Continuing the operating room scheduling through Epic generated scheduling algorithms would likely optimize operating room usage
- Implementation of adaptive operating room scheduling software in the future through continuous machine learning refinement could further optimize operating room scheduling

LESSONS LEARNED

- Although performance varied, Epic appears to perform significantly better than surgeons in predicting operating time accurately.
- These findings support the utilization of Epic when scheduling cases to improve efficiency and maximize operating room usage.